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Resistors in series and parallel problems pdf

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In previous tutorials, we learned how to connect individual resistors in series and parallel to form various circuits. Now, let's explore more complex combinations of both series and parallel resistors in the same circuit. To calculate the combined resistance, currents, and voltages for these resistive networks, we can follow a similar approach as individual series or parallel circuits. A resistor combination or mixed resistor circuit is formed by connecting resistors in both series and parallel configurations within the same circuit. Since resistors in series carry the same current and resistors in parallel have the same voltage across them, our goal is to find the total resistance, currents, and voltages for these combined circuits. Let's consider a problem with a series-parallel resistor network. We're given a 12V supply and three resistors R1 = 3Ω, R2 = 5Ω, and R3 = 4Ω. To calculate the total current taken from the supply, we first find the total resistance (RT) by adding the individual resistances: RT = R1 + R2 + R3 = 12Ω. Next, we use Ohm's Law to find the total current (i): i = V/RT = 24V/12Ω = 2A. Since it's a series circuit, the current through each resistor is also 2A. To find the voltage across each resistor, we can rearrange Ohm's Law: V1 = iR1 = 2A x 3Ω = 6V, V2 = iR2 = 2A x 5Ω = 10V, and V3 = iR3 = 2A x 4Ω = 8V. The total power (PT) is the product of the voltage and current: PT = VTi = 24V x 2A = 48W. To find the power dissipated by each resistor, we multiply the voltage across it by the current through it: P1 = V1i1 = 6V x 2A = 12W, P2 = V2i2 = 10V x 2A = 20W, and P3 = V3i3 = 8V x 2A = 16W. In another example, we have a parallel circuit with three resistors R1 = 8Ω, R2 = 6Ω, and R3 = 12Ω. To find the total resistance (RT), we take the reciprocal of the sum of the reciprocals of each resistance: RT = 1/R1 + 1/R2 + 1/R3 = 18/48Ω. The total current (i) is found using Ohm's Law with the total resistance: i = V/RT = 24V/(2.67Ω) = 9A. Since it's a parallel circuit, the voltage across each resistor is equal. Similarly, we can find the power dissipated by each resistor and the total power of the circuit. **Problem #1:** The voltage for each resistor is 24V, and they are all equal (V1 = V2 = V3). Using Ohm's law, we can calculate the current through each resistor: * R1: 24V / 8Ω = 3A * R2: 24V / 6Ω = 4A * R3: 24V / 12Ω = 2A The total power is 216W, and the power dissipated by each resistor is: * R1: 72W * R2: 96W * R3: 48W **Problem #2:** This problem involves a series/parallel circuit. The total resistance of the circuit can be calculated as follows: * R2 and R3 are in parallel, with a combined resistance (Rp) of 6Ω. * R1 and Rp are in series, resulting in a total resistance (RT) of 8Ω. The current through each resistor is: * i1 = iT = 3A * V1 = i1R1 = 6V The voltage on R2 and R3 is the same magnitude as V1, with currents i2 and i3, respectively. **Problem #3:** This problem also involves a series/parallel circuit. The total resistance of the circuit can be calculated as follows: * R2 and R3 are in parallel, with a combined resistance (Rp) of 6Ω. * R4 is in parallel with R5, resulting in a combined resistance (R45) of 7.2Ω. * R1, Rp, and R45 are in series, resulting in a total resistance (RT) of 16Ω. The current through each resistor is: * iT = V/RT = 1.5A * i1 = i23 = i45 = iT = 1.5A The voltage on each resistor can be calculated using Ohm's law. **Problem #4:** This problem involves a series/parallel circuit with five resistors. The total resistance of the circuit can be calculated as follows: * R2 and R3 are in parallel, resulting in a combined resistance (R23) of 4.8Ω. * R4 is in parallel with R5, resulting in a combined resistance (R45) of 7.2Ω. * R1, R23, and R45 are in series, resulting in a total resistance (RT) of 16Ω. The current through each resistor is: * iT = V/RT = 1.5A * i1 = i23 = i45 = iT = 1.5A The voltage on each resistor can be calculated using Ohm's law. **Problem #5:** This problem involves finding the answer to something, but it's not specified what that is. Looking at the series/parallel circuit with resistors R1 to R6, we need to find the total resistance when the level is installed between points A and B. To do this, let's break it down into steps: First, we connect resistor R5 and R6 in series (Fig.a). This gives us a new resistance of 3 Ω + 2 Ω = 5 Ω. Next, we connect this new resistance (R56) to resistor R4 in parallel (Fig.b), resulting in an equivalent resistance of 1/R456 = 1/5Ω + 1/5Ω = 2/5Ω, which simplifies to 2.5 Ω. Then, we connect R456 to resistor R2 in series (Fig.c), giving us a total resistance of 2.5 Ω + 2.5 Ω = 5 Ω. After that, we connect this new resistance (R2456) to resistor R3 in parallel (Fig.d). This results in an equivalent resistance of 1/R23456 = 1/7.5Ω + 1/5Ω = 12.5/37.5Ω, which simplifies to 3 Ω. Finally, we connect R23456 to resistor R1 in series (Fig.e), giving us a total resistance of 3 Ω + 7 Ω = 10 Ω.